



**Guidelines for Preservation and Replacement of
Historic Wood Windows in Cambridge**

Cambridge Historical Commission

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Introduction

A primary objective of the Cambridge Historical Commission is to ensure the preservation and protection of the distinct characteristics of historic buildings and places throughout the city. Historic wood windows are considered to be one of these distinct characteristics. The Historical Commission believes that the protection of historic wood windows not only preserves an irreplaceable resource but is also cost-effective to the homeowner and environmentally responsible. The following guidelines are intended to inform Cambridge property owners on the benefits of wood window restoration, and to guide property owners of locally-designated buildings and commission members in evaluating the appropriateness of window replacement.

The Cambridge Historical Commission and the city's neighborhood conservation district commissions have varying degrees of jurisdiction over window replacement within the boundaries of their designated districts (see <http://www.cambridgema.gov/Historic/meetingsprocess.html> for a description of the districts). In general, commissions have jurisdiction over all "exterior architectural features" of buildings, and no building permit may be issued for work in an historic or neighborhood conservation district until a commission has issued a Certificate of Appropriateness, Nonapplicability, or Hardship.² A Certificate of Appropriateness will

¹ These guidelines primarily pertain to the one-, two- and three-family homes that characterize the city's residential districts. Different standards may apply for apartment houses and commercial and industrial buildings.

² The Massachusetts historic district statute defines "exterior architectural features" as "such portion of the exterior of a building or structure as is open to view from a public street, public way, public park or public body of

be issued when the commission determines that the work is not incongruous to the character of the building or district; a Certificate of Hardship will be issued if the applicant demonstrates hardship, financial or otherwise, and the proposed work will not have an adverse effect on the district; and a Certificate of Nonapplicability will be issued if the work is judged to be not within the jurisdiction of the commission, or not visible from a public way.³

Why Preserve Historic Wood Windows?

Windows are an essential component of buildings, both as a means for light, ventilation, and visibility, and as an architectural feature. By providing scale, profile, and composition to a façade, windows are often one of the most important character-defining features of a structure. Federal preservation guidelines advise that "windows should be considered significant to a building if they: 1) are original, 2) reflect the original design intent for the building, 3) reflect period or regional styles or building practices, 4) reflect changes to the building resulting from major periods or events, or 5) are examples of exceptional craftsmanship or design."⁴ Today's busy homeowner is often led to believe that old windows cannot be repaired, and

water, including but not limited to the architectural style and general arrangement and setting thereof, the kind, color and texture of exterior building materials, the color of paint or other materials applied to exterior surfaces and the type and style of windows, doors, lights, signs and other appurtenant exterior fixtures; (M.G.L. Ch. 40c, Sec. 5).

³ The statute defines the scope of the commission's review: "In passing upon matters before it the commission shall consider, among other things, the historic and architectural value and significance of the site, building or structure, the general design, arrangement, texture, material and color of the features involved, and the relation of such features to similar features of buildings and structures in the surrounding area" (MGL Ch. 40C, Sec. 7).

⁴ Myers, John. "Preservation Brief 9: The Repair of Historic Wooden Windows." Technical Preservation Services, U.S. Department of the Interior (1981) (<http://www.nps.gov/history/hps/tps/briefs/brief09.htm>)

that they are inconvenient, high maintenance, inefficient, and ultimately replaceable. Historic wood windows were built to last, however, and some are still in service after two centuries or more.

A Brief History

Moveable wood sash windows date back to the early 1700s. Early sash construction techniques evolved into an intricate combination of molded wooden members (“muntins”) to hold panes of glass. Early wood sash windows were marked by thick muntins and small panes, or lights, due to the high price of glass. As glass technology improved and prices decreased, lights became larger and muntins became thinner.

By the late eighteenth century, dimensions of windows were standardized according to the sizes of glass imported from Britain.⁵ The principal window type of this era was the double-hung sash, which is commonly found today in Cambridge’s older buildings. Sash construction remained a complex process, and windows were milled from old-growth lumber that is denser than the wood available today – one reason for the longevity of these windows.

Historically, the character and configuration of window sash have been essential to the style of a building. Nineteenth century muntin profiles and sash designs changed with evolving architectural styles, demonstrating deliberate design choices and skilled craftsmanship. Window glass manufactured before the mid-1920s exhibits wavy patterns and defects that are an important characteristic of older buildings. Historic windows are detailed differently than modern windows, and their old glass provides a markedly different pattern

⁵ There are local window companies that manufacture a “Boston Pattern” sash based on these eighteenth-century standards, which will fit nearly any window opening in Cambridge. “New York” pattern windows sold in western and southern New England are slightly different.

of reflection from modern glass. Preserving the sometimes subtle distinctions between modern and historic sash is critical to maintaining the historic character of a building.

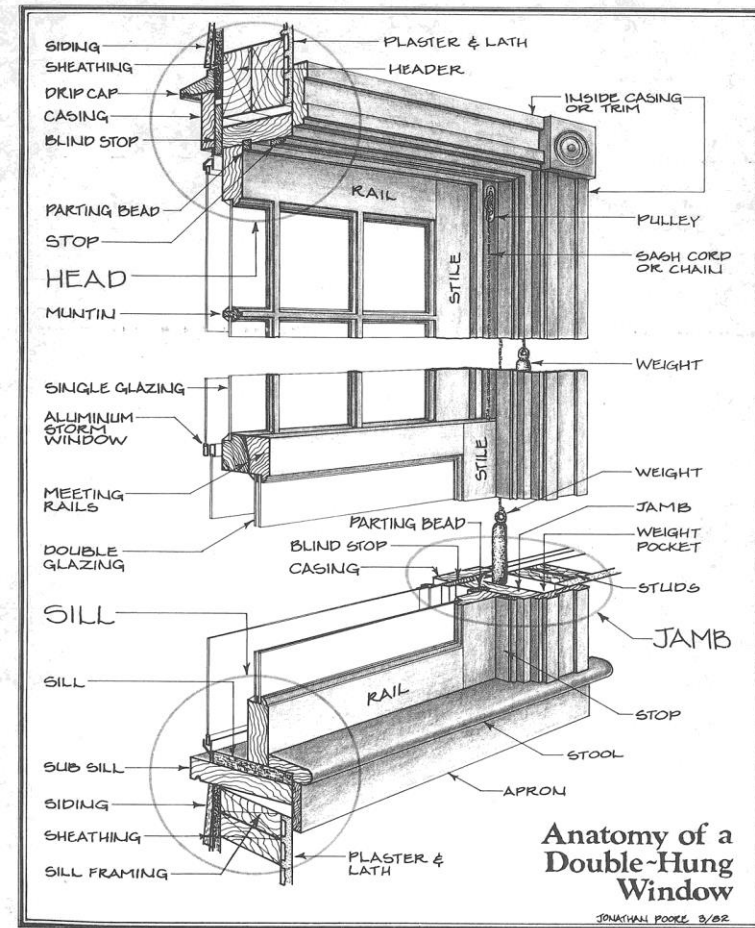


Figure 1: The Anatomy of a Double-Hung Window. Image source: <http://www.cityofalbany.net/comdev/historic/windowparts.jpg>
Consider Restoration before Replacement

The staff of the Cambridge Historical Commission receives proposals for and inquiries about window replacement on a regular basis, a reflection of the rapid growth of the window replacement industry. Property owners are sometimes reluctant to hear the case for restoring historic wood windows opposed to their replacement. The benefits of window restoration can be summed up under three categories: Sustainability, Energy-Efficiency, and Historic Character.

Sustainability

An important facet of preserving historic buildings is the retention of original components. Like most structural elements of older, wood-framed buildings, historic wood windows were milled from old-growth lumber that can last centuries, even when not properly maintained. Their sustainability is complemented by the fact they were carefully constructed with mortise and tenon joinery to fit tight into the window openings of a house with extreme care and craftsmanship. Mass-produced wood replacement windows are typically constructed of new-growth lumber, often with glued-together finger joints and are highly susceptible to rot. The preservation of an old window maintains an irreplaceable, sustainable resource.

In addition to craftsmanship and the durability of the wood, historic wood windows are also sustainable in that they are easily repairable. With the abundance of allegedly “maintenance-free” replacement window options on the market today, it’s not surprising that property owners are often inclined to do away with old wood windows. “Maintenance-free,” however, is a misleading claim. Any product that is in constant operation and is susceptible to seasonal fluctuations and weathering will need maintenance. Replacement windows typically have plastic and metal parts that become outmoded over time, making them difficult (if not

impossible) to repair. Vinyl windows are prone to denting, warping and fading in high temperatures.⁶ In most cases, wood replacement sash have aluminum or vinyl exterior cladding meant to protect the wood as an alternative to storm windows. However, if moisture finds its way in, through weep holes or other infiltration sources, the new-growth lumber shielded beneath the cladding can quickly rot.⁷



Figure 2: Cross-section of insulating glass in a vinyl replacement window unit

Another major claim of the window replacement industry is insulating glass. Insulating glass involves two panes of glass with an inert gas sealed in the space between them; these windows are called “double-glazed.” Their design, however, does not lend to sustainability. Windows with insulating glass come with only a 15 to 20 year warranty; when the sealant fails, the window will

⁶ Paul Fiset, “Understanding Energy-Efficient Windows,” *Fine Homebuilding* 114 (1998): 68-73

⁷ See for example, class action suit brought against Pella Windows in February 2008 from homeowners who alleged that their Proline aluminum-clad wood replacement windows had design flaws that allowed water penetration beneath the exterior cladding, causing premature rotting in the sash. http://www.freedweiss.com/investigations_pella.htm

lose its insulating quality, the glass will fog, and the entire window may have to be replaced.⁸ Historic wood windows with a single pane of glass can be repaired with tools found at a local hardware store and will last up to 10 times longer than a replacement model. Homeowners should be aware that the payback period for restoring wood windows and installing quality storm windows is significantly less than installing replacement windows. In sum, the term “replacement window” means just what it says – it will have to be replaced again and again.

As global warming and related “green” issues are in the headlines, recycling and sustainability are important terms. Window restoration incorporates both of these concepts. Restoration of existing wood windows reduces both landfill waste and the production of the energy-consuming, synthetic materials found in many replacement windows. Hiring a local window restoration specialist to work on your windows also helps sustain local economies as *labor* intensive, opposed to *materials* intensive, concept.

Energy-Efficiency

Much like sustainability, energy efficiency is an important factor in the “green” discussion and is often the primary reason homeowners look to replace their windows. The generally erroneous notion is that older wood windows are not as energy efficient as today’s double-glazed replacement models. However, window replacement companies will often compare their product to an unrestored wood window with little or no weatherstripping and a poor (or no) storm window. With proper repair and maintenance, coupled with weather stripping and a quality storm window, *a single-glazed*

⁸ Walter Sedovic and Jill H. Gotthelf, “What Replacement Windows Can’t Replace: The Real Cost of Removing Historic Windows,” *APT Bulletin: Journal of Preservation Technology* 36:4 (2005): 25-29

historic wood window will have a comparable level of energy efficiency to that of a double-glazed replacement window. Industry guidelines indicate that the addition of a storm window to an existing single-glazed window will reduce the energy loss through the window area by approximately 50%.⁹ As replacement window manufacturers will attest, the best insulation on a small scale is dead air space. The extra dead air space created with a sealed storm window (typically 2”) means more insulation and increased energy efficiency. Replacement window dead air space between the double-glazing is only 1/16 to 1/32 of an inch.

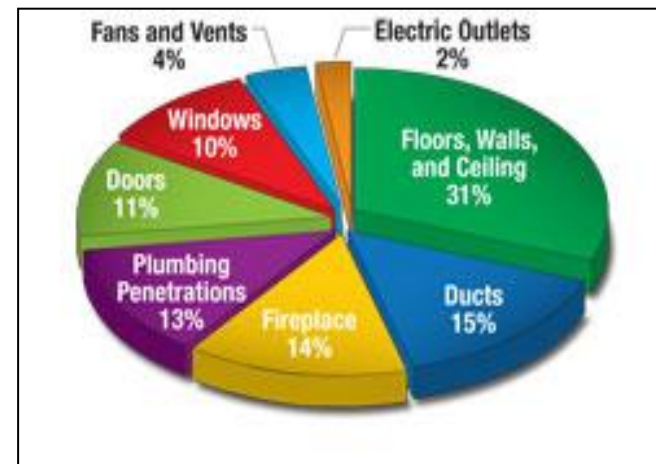


Figure 3: “Air Escape” chart from the U.S. Department of Energy

⁹ Several studies reveal comparable energy savings between a restored single-glazed wood window/storm combination and a double-glazed replacement window. See Bill Mattinson, et. al., “What Should I Do About My Windows?” *Home Energy* 19/4 (2002); Noelle Lord, “Embracing Energy Efficiency,” *Old House Journal* (September/October 2007); Andrew Shapiro and Brad James, “Creating Windows of Energy-Saving Opportunity,” *Home Energy Magazine Online* (September/October 1997), <http://homeenergy.org/archive/hem.dis.anl.gov/eehem/97/970908.html>.

It is important to note that infiltration of air, rather than heat loss through the glass, is the principal culprit affecting energy efficiency; it can account for as much as 50% of the total heat loss of a building.¹⁰ Moreover, most of the heat loss in an old house occurs in areas other than windows. Insulation in walls, attics, and between floors, and weather stripping around doors will help prevent loss of heat.¹¹ Replacement window manufacturers also often misquote U-values as the value through the center of the glass (the location of the best U-value) and not for the entire unit.¹² A U-value is a rating

of energy efficiency for all the *combined* components of a window or door – the lower the U-value, the greater the efficiency. An optional feature of replacement windows is “low-e” (low emissivity) glass, a microscopically thin, virtually invisible, metal or metallic oxide layer deposited directly on the surface of one or more of the panes of glass. The low-e coating reduces the infrared radiation from a warm pane of glass to a cooler pane, thereby lowering the U-factor of the window. The same effect can be achieved with low-e storm windows and/or energy-saving window film that can be applied directly to single-glazed windows.

Let the Numbers Convince You: Do the Math



Figure 4: Energy-savings comparison chart for original and replacement windows. Reprinted courtesy of Old-House Journal, 4125 Lafayette Center Drive, Ste. 100, Chantilly, VA, 20151, www.oldhousejournal.com

¹⁰ Sedovic and Gotthelf, 27.

¹¹ The U.S. Department of Energy has detailed information on air infiltration and other energy-loss related issues at http://www1.eere.energy.gov/consumer/tips/air_leaks.html

¹² Sedovic and Gotthelf, 27.

Historic Character

A third reason to restore existing wood windows is the retention of character-defining features of historic wood windows that are nearly impossible to duplicate with double-glazed replacement windows. As mentioned earlier, the muntin profiles and old glass in wood windows are distinct characteristics of a historic façade. Replacement windows or sash rarely have the same details. The traditional 1/2" or 5/8" exterior muntin with a putty bead is difficult to reproduce in an insulated glass, true divided light window, and is extremely costly. Many wood replacement windows have a muntin at least 7/8" wide with an inappropriate moulded profile affixed to the glass and not actually holding individual panes of glass (referred to as a “simulated divided light” to simulate a true divided light profile). Cheaper models, typically vinyl or aluminum windows, feature removable grilles or grilles between the glass, providing no profile, depth, or shadow lines. Some replacement windows will decrease the glazed opening by as much as 3" in width, with a significant loss of light and alteration of the appearance.

Replacement windows will also often require a change in a window’s rough opening because these products are based on

national standards and do not match “Boston Pattern” dimensions – window sash sizes that have been standard in the Boston area since the 18th century. This will involve an increase in vinyl or aluminum framing members to hold the replacement window properly, detracting from the historic character of a building. Custom sizing will add to the expense of replacement windows.



Figure 5: A vinyl replacement window (top) detracts from the historic character of this house, and is in distinct contrast with the original wood window below it

It is often argued that storm windows have a negative impact on the historic character of wood windows. An important point to consider is that storm windows have been used for over 100 years. Although aluminum storm windows do not replicate the appearance of wood storms, they are allowed without review in historic districts and neighborhood conservation districts and are always preferred to window replacement unless the windows themselves are judged not significant. Storm windows are a fully-reversible alteration that protect the original fabric of the building and can make the window assembly as energy-efficient as replacement windows. For optimal results, the storm windows meeting rails should correspond to the position of the existing meeting rails of the sash and match in color.¹³ Contact the Historical Commission for appropriate models.

When is Replacement Acceptable?

In some cases, an old wood sash may be beyond repair and need to be replaced. In such a situation, replacing the historic, single-glazed wood sash with a single-glazed reproduction wood sash is the preferred option. It is important that the new sash have the same number of lights (unless the existing sash are themselves inappropriate replacements – contact the Historical Commission for advice). Coupled with a quality storm window, this solution satisfies much of the rationale for restoration listed above. The staff of the Historical Commission has compiled a list of window manufacturers that produce single-glazed, true divided light windows. Local manufacturers such as Brosco and Boston Sash & Millwork feature a line of Boston Pattern wood sash. Several other manufacturers produce custom wood sash that are authentic reproductions of historic sash.

¹³ Interior storm windows or energy panels are a secondary option but can damage casings and sills and cause condensation on the interior face of the sash. Moreover, the exterior face of the sash is not protected from the elements.

If a double-glazed replacement window is the only option, Commissions will generally consider how the proposal will impact the historic character of a building; namely how closely the replacements match the originals in pattern, details, materials and finishes as closely as practicable. Dimensions and profiles of casings, sills, jambs, meeting rails and muntins are all subject to review. Some manufacturers have been able to produce double-glazed wood windows with muntin profiles that are a closer match to those found on single-glazed sash; contact the Historical Commission for recommended models. Although there have been advances in recreating the details of historic windows, the sustainability and energy efficiency issues are still highly debatable. However, there are replacement models of higher quality than others. Replacing a pre-existing replacement window with an in-kind replacement window is typically reviewed and approved at the staff level, as well as windows that are not visible from a public way.

It is essential to distinguish between “windows” and “sash,” especially when discussing their potential replacement. “Replacing a window” means removing the entire window, including the sash, the jambs, the interior and exterior casings, and the sill, and installing an entirely new unit. This is often problematical because the casings will almost inevitably have different dimensions from the original, leaving gaps against both exterior and interior finishes. Unless specially ordered, modern windows will have a different configuration of casings, stops, and screens, dimensionally-thinner sills and casings, and will sometimes occupy a different plane in the wall.

“Replacing a sash” means replacing the moveable parts of a window, leaving the casings, jambs and sill intact. There are two approaches to replacing sash:

- Replacing the sash and balances only. Locally-made Boston Pattern sash fit window openings from all periods. Sash can

be replaced with new spring balances that eliminate sash weights and allow weight pockets to be filled with insulation. This operation may have little or no effect on the exterior architectural character of the house.

- Replacing the sash with a new window, within the existing jambs. Some manufacturers offer replacement windows containing both sash and jambs that are made to fit within the existing jambs. This may seem like an attractive alternative, but the additional width of the extra jambs and balances introduces new visual elements and can significantly reduce the size of the glazing.



Figure 6: An entire replacement window unit. Note the framing system required to hold the sash, which reduces the window’s rough opening

What about Lead Paint?

Lead paint was banned by the federal government in 1978 to reduce the risk of lead poisoning in children. In older homes, windows, in particular, may contain lead paint. The repeated use and operation of the window sash may increase the likelihood of paint chipping and the creation of lead dust. Property owners are often concerned that the presence of lead paint on windows may require immediate replacement of the windows. Although it is not uncommon to find lead paint on historic wood windows, lead abatement can be achieved without posing serious health hazards. A licensed risk assessor can confirm the presence and location of lead paint and a licensed lead abatement contractor should be able to stabilize and treat it appropriately. Homeowners need to be aware that certain methods of lead paint removal, including electric sanding without proper filter vacuums and the use of heat guns, are illegal. This is especially critical when hiring a paint contractor or window restoration specialist to work on site, as these methods can produce dust and are considered a potential health hazard for the worker(s), but more importantly, for children under the age of six. With proper precautions and safety measures, however, historic wood windows with lead paint can be remedied.

In legal terms, the Code of Massachusetts Regulations directs a property owner to fully comply with State lead abatement procedures when a child under six years old resides in a house or building where lead paint is identified by a certified lead inspector.¹⁴ The regulations do not require the immediate removal of windows or window sash containing lead paint, but rather careful and thorough abatement. Special consideration is given to buildings on the State Register of Historic Places, recommending offsite stripping and reinstallation of any components containing lead paint and

¹⁴ See CMR 460.000, "Lead Poisoning Prevention and Control" from the Department of Public Health.

advising against permanent removal of "historic architectural features" such as wood sash.¹⁵ The abatement method, either through stripping of the lead paint or replacing the sash, is ultimately at the discretion of the homeowner.

For More Information

For additional information on the Massachusetts Lead Law and lead paint removal please visit <https://www.mass.gov/orgs/childhood-lead-poisoning-prevention-program> or call 800 532-9571.

To learn about property owner responsibilities, see this summary: <https://www.mass.gov/service-details/learn-about-massachusetts-lead-law>.

This database will help you determine if a property has had lead hazards identified and/or has a letter of compliance: <https://eohhs.ehs.state.ma.us/leadsafehomes/default.aspx>.

Call the Cambridge Public Health Department at 617 665-3831 for information about childhood lead poisoning or lead exposure.

Contact the Historical Commission

All residents of Cambridge are encouraged to contact CHC staff for technical assistance with window restoration or replacement.

If you live in a historic or neighborhood conservation district or own an otherwise designated property you must obtain a Certificate of Appropriateness for window replacement

Cambridge Historical Commission
831 Massachusetts Avenue
617.349.4683 or histncds@cambridgema.gov

¹⁵ Ibid.

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